REQUEST FOR INFORMATION (RFI)
VA-251-12-B-0121

PROJECT NUMBER:	515-313	Please ensure that before submitting questions or requests for clarification that you thoroughly read the solicitation, specifications, drawings and other pertinent documents. When submitting questions on this project the Government requires contractors to specifically identify the specification and/or solicitation section(s) or drawing number(s) in reference to the question or request for clarification submitted. No question or request for clarification will be answered by the Government unless the above requirements are met. Failure to comply may prevent the Government from responding in a timely manner.
PROJECT TITLE:	Mental Health Renovation B7	
PROJECT LOCATION:	Department of Veterans Affairs Battle Creek VA Medical Center 5500 Armstrong Road Battle Creek, MI 49037	

SUBMITTED BY:	Dave Sargent - DeMaria Building Co.	City/State:	Novi, MI
PHONE NO.:	248-596-2296		

TO:

Sonny Earls, Contract Specialist
Department of Veterans Affairs
Aleda E. Lutz VA Medical Center
1500 Weiss St.
Saginaw, MI 48602

RFI NO.: 002	**DATE: 8-17-12**	**SPEC/DWG. REFERENCE:** **General**
REPLY NEEDED BY: 8-22-12		

INFORMATION NEEDED:
Are soil reports available for the addition?

REPLY:

See attached soil boring report.

REPLY FROM: Keith Pounders, Sr. Project Manager Albert Kahn Associates, Inc.	DATE: August 17,2012
ATTACHMENTS: SME Geotech Report 10-26-12	COPY TO:

above ground storage tank
air quality
asbestos/lead-based paint
baseline environmental assessment
brownfield redevelopment
building/infrastructure restoration
caisson/piles
coatings
concrete
construction materials services
corrosion
dewatering
drilling
due care analysis
earth retention system
environmental compliance
environmental site assessment
facility asset management
failure analyses
forensic engineering
foundation engineering
geodynamic/vibration
geophysical survey
geosynthetic
greyfield redevelopment
ground modification
hydrogeologic evaluation
industrial hygiene
indoor air quality/mold
instrumentation
masonry/stone
metals
nondestructive testing
pavement evaluation/design
property condition assessment
regulatory compliance
remediation
risk assessment
roof system management
sealants/waterproofing
settlement analysis
slope stability
storm water management
structural steel/welding
underground storage tank

GEOTECHNICAL EVALUATION REPORT

DEPARTMENT OF VETERANS AFFAIRS –
RENOVATION OF HEALTH CLINIC B-7
BATTLE CREEK, MICHIGAN

SME Project No. 064433.00
October 26, 2011

Soil and Materials Engineers, Inc.

Soil and Materials Engineers, Inc.
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October 26, 2011

Mr. Robert Keith Pounders
Senior Associate, LEED AP
Project Management
Albert Kahn Associates, Inc.
7430 Second Avenue
Detroit, Michigan 48202

Via E-mail: keith.pounders@akahn.com (pdf file)

RE: Geotechnical Evaluation
Department of Veterans Affairs -
Renovation of Health Clinic B-7
Battle Creek, Michigan
SME Project No. 064433.00

Dear Mr. Pounders:

We have completed our geotechnical evaluation for the proposed Department of Veterans Affairs (VA) Building B-7 Renovation in Battle Creek, Michigan. This report presents the results of our observations and analyses, our geotechnical and pavement recommendations, and general construction considerations based on the information disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Jeffery M Krusinga / for

Timothy J. Mitchell, PE
Principal Consultant

Distribution: Mr. Gar Hoplamazian, PE – Albert Kahn Associates, Inc – via email: gar.hoplamazian@akahn.com (pdf file)

Mr. Andrew Rossel, PE – Hurley Stewart – via email: arossell@hurleystewart.com (pdf file)

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Geotechnical Notes
Unified Soil Classification System (USCS)
Boring Logs (B1 through B4 and P1 through P5)

APPENDIX B: Important Information about your Geotechnical Engineering Report
General Comments
Laboratory Testing Procedures

SUMMARY

The report conclusions and recommendations are summarized as follows:

1. The soil conditions encountered at the borings generally consisted of surface asphalt or topsoil overlying 2 to 6 feet of sand fill (at some locations), underlain by natural sands extending to the explored depth of the borings. Groundwater was not encountered during the drilling operations.
2. Based on the relatively shallow depth of the existing fill, we recommend shallow foundation excavations extend through the fill so that foundations bear on engineered fill directly over natural sand. However, the existing sand fill is generally considered suitable for support of floor slabs and pavements provided the subgrade is properly evaluated and prepared as discussed in the body of this report, and the Owner is willing to accept a relatively low increased risk of greater than typical settlement. To reduce (but not eliminate) the risks associated with constructing over the existing fill, SME must observe subgrades and test the soil during construction.
3. The natural sand and some of the sand fill encountered at the site is generally considered suitable for reuse as engineered fill and portions of these materials may meet MDOT Class II gradational requirements. However, because some of the sand fill contained varying amounts of silt, and was in a generally dry condition, moisture conditioning may be necessary to achieve suitable moisture contents to meet the project density requirement.
4. A maximum net allowable soil bearing pressure of 2,500 psf is recommended to design the foundations bearing on engineered fill over properly evaluated and prepared natural soils as discussed in this report. SME must observe and test foundation subgrades during construction, to evaluate the suitability of the subgrade for foundation support, and to identify locations where improvements are needed. The contractor must densify the existing fills by compacting them in-place, and must also remove any unsuitable materials or materials that cannot be properly densified, and replace them with engineered fill. Contractors should include densification of the subgrade in their base bids, and should provide unit prices for removal and disposal of unsuitable soils and replacement with engineered fill.
5. Care must be exercised by the contractor when excavating and compacting to avoid damage to nearby existing structures and utilities.
6. A conventional asphalt concrete over aggregate base pavement section is provided in Section 5, along with recommendations for materials, subgrade preparation, and drainage.

The summary presented above includes selected elements of our findings and recommendations and is provided solely for purposes of overview. It does not present crucial details needed for the proper application of our findings and recommendations. It should, therefore, not be considered apart from the entire text of this report and appendices, with all of the qualifications and considerations mentioned therein which are best evaluated with the active participation of SME.

REPORT PREPARED BY:

Andrew T. Bolton, PE
Senior Geotechnical Engineer

Kevin J. Glupker, PE
Senior Pavement Engineer

REPORT REVIEWED BY:

Timothy J. Mitchell, PE
Principal Consultant

1.0 INTRODUCTION

This report presents the results of the geotechnical evaluation performed by Soil and Materials Engineers, Inc. (SME) for the Department of Veterans Affairs (VA) Building B-7 Renovation in Battle Creek, Michigan. This evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P02477.11, dated September 22, 2011. This evaluation was authorized by Mr. Keith Pounders, LEED AP, with Albert Kahn and Associates, Inc. (Albert Kahn).

SME was provided with the following information to assist us with the preparation of this report:

- Drawings (Sheet Nos. AE100, AS100, SS100, X000 and an unnumbered drawing depicting topographic information) titled "Renovate Mental Health Clinic B7", dated 8/5/11 and prepared by Albert Kahn.
- An undated and untitled drawing depicting finish floor elevations provided by Albert Kahn.

1.1 Site Conditions

The site is located at the existing Building B-7 on the south side of Dewey Lane and east of Shafter Circle South, within the VA Hospital facility, in Battle Creek, Michigan. The project site is bounded by Dewey Lane to the north, Shafter Circle South to the west, Building 12 to the south, and Building 39 to the east.

When this evaluation was performed, the project site consisted of the existing Building B-7, an asphalt parking lot located west of Building B-7, asphalt drives on the west and north sides of Building B-7, Portland cement concrete sidewalks surrounding the perimeter of Building B-7, and maintained grass and deciduous trees located west, north, and east of Building B-7. The ground surface at the site appeared relatively flat at the time of our visit. Based on the referenced topographic drawing, existing ground surface levels at the project site generally range from about elevations 916 to 921 feet.

The existing Building B-7 consists of a two-story brick building with a daylight basement (i.e., lower level) that is supported on shallow foundations. According to Mr. Andrew Rossel, PE with Hurley Stewart, the lower finish floor elevation directly adjacent to the proposed addition is 914.8 feet, and according to Mr. Steve Hinman, PE with Albert Kahn, a below-grade basement extends to elevation 908.8 feet.

Based on the USGS Augusta Quadrangle dated 1985, the Kalamazoo River is located about 1 mile north of the site and the water surface of the Kalamazoo River is between approximately elevation 800 and 805 feet.

1.2 Project Description

The project will consist of the design and construction of a two-story building addition to the existing Building B-7, renovations within the existing structure, a recessed loading dock, and pavements. Currently, an attached one-story building is located in the vicinity of the proposed addition. We understand the attached one-story building will be demolished prior to construction. The building addition is proposed to be constructed in the vicinity of borings B1 and B2, the loading dock is proposed to be constructed in the vicinity of either boring B3 or boring B4, and pavements are proposed to be located in the vicinity of borings P1 through P5, as depicted on the Boring Location Diagram included in Appendix A.

The Building B-7 addition will consist of a two-story structure with a daylight basement (lower level). Typical gravity column loads are anticipated to be less than 250 kips and typical gravity wall loads are anticipated to be less than about 2 kips per linear foot. The proposed lower level floor slab elevation for the addition is 916.87 feet, about 2.07 feet above the existing lower level floor slab elevation of Building B-7, directly adjacent to the addition. Based on the referenced documents, cuts in the range of about 2 feet are anticipated to reach the design subgrade levels for the proposed addition.

The loading dock will be recessed and will provide access to the lower level of Building B-7. According to Mr. Rossell, PE, the loading dock is preliminarily proposed to be located in the vicinity of boring B3, with a slab elevation of 910.8 feet, which is about 4 feet below the adjacent lower level finish floor elevation of the existing building. Therefore, we anticipate undercuts extending below the existing shallow foundations may be required to construct the loading dock. Undercuts should not be performed below existing shallow foundations without first underpinning the shallow foundations as discussed in Section 4.5 of this report. Additionally, based on the referenced documents, cuts in the range of about 8 to 9 feet are anticipated to reach the design subgrade levels for the proposed loading dock. Therefore, the loading dock will be recessed by about 8 to 9 feet, thus requiring permanent retaining walls on each side, which we understand will be designed by others.

The proposed pavement areas are anticipated to consist of asphalt concrete. The proposed pavements will be used for parking and access of primarily lightly loaded passenger vehicles. We understand existing pavements in the area of proposed pavements will be completely removed prior to construction of the proposed pavements. We were not provided with a final grading plan; however, based on the referenced documents, we anticipate cuts of fills of less than 1 foot will be required to reach the design subgrade levels for the proposed pavements.

2.0 EVALUATION PROCEDURES

2.1 Field Exploration

SME completed nine borings (B1 through B4 and P1 through P5) at the site on October 7 and 10, 2011. Borings B1 through B4 extended 30 to 60 feet below the existing ground surface, and borings P1 through P5 each extended 5 feet below the existing ground surface for a total of 185 linear feet of drilling. The approximate locations of the borings are depicted on the Boring Location Diagram included in Appendix A of this report.

Albert Kahn and SME jointly determined the number, locations, and depths of the borings. SME staked the locations of the borings in the field using approximate taping referenced from existing site features. SME estimated the ground surface elevations at boring locations B1 through B4 to the nearest 0.1 foot using an optical level. SME estimated the ground surface at boring locations P1 through P5 to the nearest 1 foot based on linear interpolation of the existing topographic information provided on the referenced documents. The actual elevations at the boring locations should be determined by the project surveyor.

The borings were drilled using a truck-mounted, rotary-type drill rig and were advanced using continuous-flight, solid-stem augers, except at boring B1 where hollow-stem augers were used. The borings included soil sampling based upon the Split-Barrel Sampling procedure. Recovered split-barrel samples were generally sealed in glass jars by the driller.

Groundwater level measurements were recorded during and immediately after completion of each boring. The boreholes were backfilled with cuttings and the surface patched with cold-patch (in paved areas) after completion. Therefore, long-term groundwater levels were not obtained from the borings.

Soil samples recovered from the field exploration were returned to the SME laboratory for further observation and testing.

2.2 Laboratory Testing

The general laboratory testing program consisted of performing visual soil classification on recovered samples in accordance with the Unified Soil Classification System (USCS).

Additionally, a loss-on-ignition (LOI) test was performed on a topsoil layer encountered within the sand fill at boring B1. Since the soils encountered in the borings were granular (i.e., sandy) in nature, other geotechnical tests were not performed in the laboratory.

The Laboratory Testing Procedures in Appendix B provide general descriptions of the general laboratory tests given above. Upon completion of the laboratory testing, boring logs were prepared and include materials encountered, penetration resistances, pertinent field observations made during the drilling operations, and the results of certain laboratory tests. The boring logs are included in Appendix A. The soil descriptions included on the boring logs were developed from both visual classification and the results of laboratory tests, where applicable. The approximate existing ground surface elevations at the boring locations are also provided on the boring logs.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, soil samples are normally retained in our laboratory for 60 days and then disposed, unless instructed otherwise.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Conditions

The soil conditions encountered at the borings generally consisted of surface materials (e.g., asphalt concrete or topsoil) overlying existing sand fill, underlain by natural sand extending to the explored depths of the borings. A generalized summary of the materials encountered at the current boring locations, beginning at the existing ground surface and proceeding downward, is provided below.

Stratum 1: Surface Asphalt and Topsoil Materials. The driller reported about 3.5 inches of asphalt concrete at boring B1, and about 6 to 16 inches of topsoil at the remaining borings, excluding boring P4 where fill was encountered at the ground surface.

Stratum 2: Existing Sand Fill. Existing sand fill was encountered below the surface materials at borings B1 through B4 and at the ground surface at boring P4. The fill extended about 2 to 6 feet below the ground surface. Debris consisting of brick fragments was encountered in the fill at borings B2 and P4, topsoil layers and seams were encountered in the fill at borings B1, B3, B4, and P4. Standard Penetration Test (SPT) resistances (N-values) from 6 to 20 blows per foot of penetration (bpf) were obtained in the sand fill, indicating a loose to medium dense condition.

Stratum 3: Natural Sand. Natural sand was encountered below the existing sand fill at the borings B1 through B4, and boring P4, and below the surface material at borings P1, P2, P3, and P5, and extended to the explored depths of the borings. The natural sand ranged from fine to coarse in texture and contained varying amounts of silt and gravel. N-values from 4 bpf to 50 blows per 4 inches indicated the natural sand was in a very loose to extremely dense condition.

The soil profile described above and included on the appended boring logs is a generalized description of the conditions encountered. The stratification depths described above and shown on the boring logs are intended to indicate a zone of transition from one soil type to another. They are not intended to show exact depths of change from one soil type to another. The soil descriptions are based on visual classification of the soils encountered. Soil conditions may vary between or away from the boring locations. Please refer to the boring logs for the soil conditions at the specific boring locations.

Thickness measurements of the surface materials reported on the boring logs should be considered approximate since mixing of these materials can occur in small diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents, or for purposes of design, additional evaluations such as pavement cores, should be performed.

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil, or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, the delineation of fill described above and on the appended boring logs should be considered approximate only. A better understanding of the extent and composition of the fill can be achieved by observing test pit excavations.

3.2 Groundwater Conditions

Groundwater was not encountered during or upon completion of drilling at the borings. Based on the relatively permeable nature of the granular soils encountered, we believe the groundwater conditions reported herein are representative of the groundwater levels/elevations at the time of the field exploration, and that the static groundwater level was below the explored depths of the borings.

Hydrostatic groundwater levels, perched conditions, and the potential rate of infiltration into excavations should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, the level of the Kalamazoo River, and other factors. The groundwater levels indicated by the borings represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary.

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 Site Preparation and Earthwork

4.1.1 Existing Fill Considerations

Existing sand fill was encountered in the upper 2 to 6 feet at borings B1 through B4 and P4. The origin of the existing fill at this site is not known and we are not aware of records that document the fill placement or any compaction operations during placement. The existing fill contained occasional brick fragments and topsoil seams. A LOI test performed on a topsoil layer contained in the fill at boring B1 indicated about 4.9 percent organic matter. Frequent layers and seams of topsoil were encountered in boring B1 and a significant amount of topsoil was encountered within the fill at boring P4, while the existing fill encountered in borings B2 through B4 did not appear to contain significant amounts of topsoil. The fill was in a loose to medium dense condition and is judged to be somewhat less dense than a suitably compacted engineered fill.

Based on the limited depth of the existing sand fill, we recommend extending shallow foundation excavations into the inorganic natural sands below the existing sand fill. However, based on the condition and limited depth of the existing fill, we believe it is feasible to support floor slabs and pavements above most of the existing fills at this site, thereby reducing construction costs associated with removing and replacing the fill in its entirety.

There are additional risks of unsuitable performance associated with constructing slabs-on-grade and pavements above undocumented fill. Based on the borings, we believe these risks at this site are relatively low, and could include greater than typical settlement and associated cracking of slabs and surface distortions of pavements. In our opinion, these risks can be further reduced to a low level (but not eliminated) by evaluating the fill during construction and preparing subgrades as discussed below. However, if the relatively low risks presented above are not acceptable to the owner, the existing fill should be removed and replaced with engineered fill. SME would be pleased to discuss the anticipated risks in more detail with the owner and/or design team, if desired.

The existing fill can be further characterized by performing shallow test pits in the presence of SME, particularly in the areas of borings B1 and P4. Suitable existing fill materials should be relatively consistent with depth, display sufficient strength/resistance, and be free of voids, significant organics, or significant construction debris. Additional testing of the fill, which should be performed and/or documented by SME, includes testing using hand-operated augers and penetrometers capable of testing soils several feet below the design subgrade levels.

SME should also observe the fill in the sidewalls of the foundation excavations. Suspect materials should be further evaluated, and overly loose or disturbed materials that cannot be improved in-place, should be removed and replaced with engineered fill.

The recommendations provided in the following report sections are based on the assumption that the existing fill will be removed and replaced with engineered fill below foundations, but will remain in-place below the floor slab and pavements, with the Owner accepting the associated relatively low level of increased risk, as described above. We should be contacted to review and revise the recommendations of this report if it is determined the existing fill will be removed and replaced.

4.1.2 General Site Subgrade Preparation

After demolition of the attached one-story building is complete, existing foundations, slabs, and other below-grade structures from previous construction should be completely removed from foundation areas to expose suitable bearing soils, and should be removed at least 2.5 feet below final subgrade level to avoid creating "hard spots" in slab-on-grade areas. The resulting excavations to remove obstructions should be backfilled with engineered fill meeting the requirements of Section 4.1.4 of this report.

Existing utilities within the building and loading dock footprint should be rerouted around the building and loading dock. All abandoned utilities should be removed and backfilled with granular engineered fill to the design subgrade level. As an alternative, existing abandoned utilities below proposed grade slab areas may be left in-place and fully grouted, provided the abandoned utility is situated at least 2.5 feet below the final subgrade level to reduce the potential of developing "hard spots" in the subgrade. If utilities are to be abandoned in-place, the locations should be reviewed to verify the utilities do not conflict with the proposed construction. Abandoned utilities should be removed below proposed foundations. The condition of the backfill, in existing utility trenches where the utility is abandoned in-place, should be evaluated to confirm these soils are adequate for support of engineered fill and grade slabs. Unsuitable existing trench backfill should be undercut and replaced with granular engineered fill. Care should be exercised when excavating near existing utilities to protect them from damage.

The proposed building, loading dock, and pavement areas and areas to receive engineered fill should be cleared of existing pavement, concrete sidewalks, topsoil, trees, unsuitable fill, and other deleterious materials to expose the underlying inorganic soils.

After stripping and removal of deleterious materials and cuts are made to design subgrade levels, we recommend the exposed subgrade soils be subjected to a comprehensive proofrolling program. The purpose of proofrolling is to locate areas of unsuitably loose or soft subgrade.

Proofrolling should be performed with a fully-loaded, tandem-axle truck or other similar pneumatic-tired construction equipment. Areas of unsuitable (i.e., wet, loose or soft) subgrade revealed during proofrolling should be mechanically improved (compacted) in-place. If it is not possible to compact the unsuitable subgrade, it may be necessary to remove the unsuitable soils and replace them with engineered fill.

If it is not feasible to perform a proofroll in the building addition and loading dock areas, due to close proximity to the existing building, we recommend an evaluation of the exposed subgrade be performed by SME in these areas, including density testing or the use of appropriate hand-operated equipment such as hand augers and cone penetrometers. Unsuitable subgrade indicated by SME should be recompacted or removed and replaced with engineered fill.

The subgrade soils may be sensitive to disturbance when exposed to water and trafficked. If the subgrade becomes disturbed, it would be necessary to improve the subgrade in-place, if feasible, or to remove and replace the disturbed soils with engineered fill, crushed aggregate, or crushed concrete. Placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, is a traditional treatment to protect easily disturbed subgrades.

After cuts are made to design grades and after the exposed subgrade has been proofrolled or evaluated, as depicted above and improved as necessary, engineered fill may be placed on the exposed subgrade to establish final subgrade levels. Section 4.1.4 of this report presents materials and compaction requirements for engineered fill.

4.1.3 Subgrade Preparation for Floor Slabs

We anticipate the final subgrade for the building pad will consist of properly prepared existing sand fill. Prior to concrete placement for floor slabs, the building pad subgrade should again be observed and tested for suitability of floor slab support. The purpose of the re-evaluation is to identify any areas of subgrade that were disturbed during construction activities and verify subgrade conditions are suitable for floor slab support. The re-evaluation of the exposed subgrade should consist of density testing or the use of appropriate hand-operated equipment such as hand augers and cone penetrometers. Unsuitable subgrade indicated by SME should be recompacted or removed and replaced with engineered fill.

We recommend the top 4 inches of the slab subbase consist of an approved granular material. The purpose of this is to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils. MDOT Class II granular material is recommended for this purpose. Alternately, an approved aggregate such as MDOT 21AA dense-graded aggregate may be used in lieu of the granular material to provide additional protection of the subgrade and a more stable working platform for construction of the slab. The additional thickness of aggregate required to provide a stable construction platform will depend on the condition of subgrade soils during construction and the type of construction equipment to traffic the prepared subgrade. The granular material or aggregate should also be compacted per the "Engineered Fill Requirements" section of this report (Section 4.1.4).

In general, we recommend providing vapor retarders below floor slabs that will receive an impermeable floor finish/seal, or a floor covering which would act as a vapor retarder. Even if these floor coverings are not planned, the vapor retarder can reduce the transmission of moisture vapor from the ground into the building, which can occur due to thermal and humidity variations and other conditions. Plastic sheeting that is continuously placed and overlapped at least 18 inches is generally considered suitable for the vapor retarder system. For durability purposes during construction, we recommend the thickness of the plastic sheets be no less than 10 mils. The vapor retarder should be protected from damage during construction and the use of plywood "runways" may be required to transport concrete across the prepared subgrade. However, the placement of a vapor retarder affects construction of the floor slab, concrete curing, and the rate of moisture loss as the concrete dries. We would be pleased to discuss considerations related to vapor retarders in more detail, if desired.

Slabs should be separated by isolation joints from structural walls and columns bearing on their own footings to permit relative movement. A minimum of 6 inches of engineered fill should be provided between the bottom of the slab and the top of the shallow spread footing below. Otherwise, other arrangements should be made to allow for potential relative settlements, such as grade beams, thickened slabs with appropriate reinforcing steel, or other appropriate details.

Differential settlement could be manifested where grade slab of the building addition abuts the existing structure. Hard-finish flooring surfaces should not span across the interface between the existing building and the new addition without control joints, as minor cracking and/or minor settlement at the interface between the two structures is likely to occur.

The slab-on-grade subgrade soils should be protected from frost during winter construction. Any frozen soils should be thawed and compacted or removed and replaced prior to slab-on-grade construction.

Based on the above subgrade preparation procedures and the anticipated final subgrade surface consisting of properly prepared and evaluated existing sand fill, we recommend using a modulus of subgrade reaction of 150 pci for design of floor slabs. This recommended design subgrade modulus is based on correlations with soil type for plate load tests and is defined as the ultimate load applied to a 30-inch-diameter plate that deflects 0.05-inch.

4.1.4 Engineered Fill Requirements

Any fill placed within the construction area, including utility trench backfill, should be an approved material, free of frozen soil, organics, or other deleterious materials. The fill should be spread in level layers not exceeding 9 inches in loose thickness and be compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with the Modified Proctor test. Sand fill should be compacted with appropriate equipment, such as a smooth drum vibratory roller or vibratory plate compactors including either walk-behind types, or plate compactors mounted on a backhoe or excavator (hoe-pacs).

Based on the information from the borings, much of the existing sand fill and natural sand should generally be suitable for use as site engineered fill provided these soils meet the requirements listed in the previous paragraph. If the proposed fill contains more than 4 percent organics or debris, we recommend such soils not be used for engineered fill.

In other areas where compaction is accomplished primarily by hand-operated equipment and in areas where drainage is required, an approved granular material, such as MDOT Class II granular material, should be used as backfill. Thinner lifts may be required in confined spaces to achieve compaction of the backfill. Based on the borings, portions of the on-site soils (with USCS classifications "SP" and possibly "SP-SM") could meet MDOT Class II gradational requirements, and would therefore be suitable for reuse in confined areas and as drainage material. SME should verify the suitability of sands proposed for reuse by performing gradation analyses of identified soils during construction.

4.2 Foundations

4.2.1 Subgrade Verification

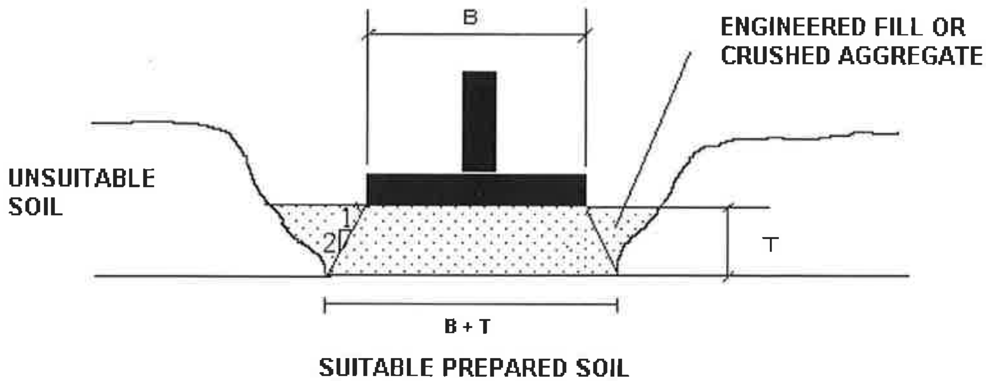
To verify suitable subgrade is exposed at the bearing surface of footing excavations, to verify the maximum net allowable soil bearing pressure, and to verify improvements at or below the foundation subgrade have been performed properly (if necessary), foundation subgrades must be evaluated and tested during construction. By preparing the geotechnical evaluation report, SME is currently the geotechnical engineer of record for this project. During construction, the firm retained to observe and test the foundation subgrade prior to construction of the footings takes responsibility as the geotechnical engineer of record for the project, and is responsible to verify the recommendations in this report are properly applied. We believe it is beneficial to the owner to retain the current geotechnical engineer of record for this project (SME) to observe and test the foundation subgrades during construction, which will allow continuity from design through construction. Because of the presence of existing fills containing brick and topsoil, we believe it is important for SME to observe and test the foundation subgrades to verify suitability for support of the design bearing pressure.

4.2.2 Spread Foundations

Shallow spread footings bearing on suitable natural sands, or on engineered fill placed over suitable natural sands, are recommended for support of the proposed building addition. We recommend a maximum net allowable soil bearing pressure of 2,500 pounds per square-foot (psf) for design of shallow isolated column and continuous foundations. Suitable bearing soils were generally encountered about 3 feet below the existing ground surface in borings B1 and B2.

To provide a uniform bearing surface and improve overly loose soil conditions, we recommend the top 12 inches of the foundation subgrade (at the design bearing level) be thoroughly compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with the Modified Proctor test using vibratory compaction equipment prior to placement of concrete. The vibratory compaction equipment should consist of a large walk-behind vibratory plate compactor capable of generating a centrifugal force of no greater than 5,500 pounds. Larger compaction equipment such as a vibratory roller or vibratory plate compactor mounted on an excavator (hoe-pack) can be considered. However the contractor must exercise caution when using large vibratory compaction equipment near the existing structures and should monitor the existing building for movement. If movements of the existing structure are observed, or anticipated based on other observations during compaction operations, the contractor must immediately cease operations, evaluate the structure, and use smaller equipment for any further work near the structure.

Any unsuitable soils encountered should either be mechanically improved in-place, or undercut to expose suitable natural soils. Excavations can then be backfilled to reestablish the design bearing pressure using engineered fill or crushed aggregates. The undercut to remove unsuitable soils should extend laterally on a two vertical to one horizontal slope from the edge of the footing. Please refer to the following Typical Foundation Undercutting Diagram:



Foundations should be situated a minimum of 42 inches below final site grade in any unheated areas for protection against frost action during normal winters. Interior foundations can be constructed at shallower levels on suitable soils just below the floor slab. However, the footings and proposed bearing soils should be protected from freezing during construction if work occurs in the winter months. In addition, any caved soils should be suitably removed from the foundation bearing surfaces before placing concrete.

The foundation excavations are generally anticipated to extend through granular soils. Therefore, we believe sloughing and caving of foundation excavation sidewalls will probably occur and believe it will be necessary to slope back the foundation excavations and vertically form the foundations and foundation walls for this project.

For bearing capacity and settlement considerations, continuous (wall) footings should have a minimum width of 20 inches and spread (column) footings should have a minimum dimension of 30 inches. In some cases, the minimum footing size criteria may govern the size of the foundation and not the allowable soil bearing pressure.

Total settlements for spread foundations are estimated to be 1 inch or less and differential settlements for foundations supporting similar loads are estimated to be about one-half of the total settlement estimate or less. The design engineer should account for differential movements between the new addition and the adjacent existing building, which could equal the total settlement of new foundations. The settlement estimates provided are based on the boring information, maximum net allowable soil bearing pressure, the referenced design structural loads, our experience with similar structures and soil conditions, and field verification of suitable bearing soils by SME.

New footings adjacent to existing footings should be constructed at the same bearing level as existing footings to reduce the potential of transmitting additional loads to the existing footings, assuming suitable bearing soil is encountered at that level. If the new footings have to be extended deeper than the bearing level of the existing footings, the project structural engineer should evaluate the design and make appropriate modifications to the new footings. Bearing levels for new footings can be established at certain distances from the existing building, depending on the distance between the two bearing levels. As a guideline, the new footing level should be at a level either above or below the existing footing no higher than its horizontal distance from the existing footing, i.e., a 1 to 1 slope between the edges of the two footings. For reasons of constructability, we recommend limiting vertical "steps" to 1 foot for every 5 horizontal feet. Excavation for new foundations should not extend below existing foundations without first properly underpinning or shoring the existing foundations.

4.3 Seismic Site Class

The project site is located in Section 31, Township 1 S, Range 8 W in Calhoun County, Michigan. Based on topographic information included on the referenced documents, existing ground surface levels at the project site vary from about elevations 916 feet to 921 feet. Based on Plate 13 (Topography of the Bedrock Surface) in the Hydrogeologic Atlas of Michigan, the estimated level of the top of rock is about elevation 700 to 750 feet based on linear interpolation of rock contours plotted at 50-foot intervals. From this information, the glacial drift at the site is roughly 166 to 221 feet thick.

According to the limited information obtained from the borings, the subgrade soils at this site can at least be designated as seismic site Class D in determining seismic design forces for this project in accordance with the 2009 MBC Code (Table 1613.5.2). However, the soil conditions may actually meet a better seismic site class, but deeper borings and/or actual shear wave velocities are needed to identify whether or not the specific site class provided in this report can be upgraded. Since the proposed structure is a two-story building addition, a better site class may not significantly impact the structural design. Therefore, the costs associated with an additional evaluation to potentially improve the seismic site class designation presented above, may not be of value. Please contact us if additional shear wave testing is desired.

4.4 Below-Grade and Retaining Walls and Drainage

Based on our understanding of the project, below-grade walls for the addition, and retaining walls for the loading dock are proposed.

Below-grade walls and retaining walls should be backfilled with granular materials meeting the gradation requirements of MDOT Class II sand. See Section 4.1.4 for placement and compaction requirements for wall backfill. The foundation recommendations presented in Section 4.2 of this report are also applicable to the design of retaining wall foundations.

For a drained granular backfill and a level finish surface behind the wall, we recommend an active equivalent fluid pressure of 40 pounds per cubic foot (pcf) for design. This earth pressure is based on the walls being flexible enough to permit the active earth pressure condition to be reached. An outward movement (away from the backfill) equal to approximately 0.001 times the height of the wall is generally required to achieve the active earth pressure condition for granular backfill. If the wall is restrained or rigid enough so that it does not rotate sufficiently to reach the active earth pressure condition, a higher lateral earth pressure (at-rest condition) should be used for design. For rigid walls backfilled with a free-draining granular material and a level finish surface behind the wall, we recommend an at-rest equivalent fluid pressure of 55 pcf for design.

Use of the above lateral pressures for flexible and rigid wall conditions requires a drained, granular wall backfill. To mitigate the potential for build-up of hydrostatic pressures against retaining walls and below-grade walls, we recommend a properly installed and maintained drain be provided in the backfill zone at the base of the below-grade and retaining walls. The drain should consist of a minimum 4-inch-diameter drain tile wrapped in filter fabric and surrounded with a minimum thickness of 6 inches of pea gravel (MDOT 34R material). Clean-outs should be provided for maintenance of the drain. If possible, the drains should be discharged to a suitable outlet via gravity drainage. Otherwise, the drains should discharge to a sump pit where a pump can discharge the drainage to a storm sewer or other suitable outlet. In addition, the ground surface behind the exterior walls should be sloped away from the wall to reduce infiltration into the wall backfill from surface run-off.

Any additional lateral wall loads resulting from surcharge loading, such as adjacent floor loads, traffic, or upward sloping ground behind the wall, should also be added to the above earth pressures. During compaction of wall backfill, care should be exercised to avoid overstressing the wall. If required, walls should be designed to accommodate the additional stresses associated with operating compaction equipment adjacent to the wall.

For use in calculating loads on walls due to surcharges, we recommend the use of a horizontal coefficient of 0.33 and 0.5 for active and at-rest conditions, respectively. Use of these values requires a granular wall backfill. Surcharge loads should be modeled as a uniform pressure distribution applied to the entire wall height.

Horizontal loads on the retaining wall foundations may also be resisted by friction along the base of the foundations. A friction factor of 0.35 may be used to compute the ultimate sliding resistance at the interface between the bottom of the concrete foundations and the supporting natural sands or engineered fill. This friction factor should be used with a safety factor of at least 1.5 for design against sliding.

The design of retaining structures should include checking sliding stability, overturning stability, the location of the resultant force at the base, and the contact pressure at the base. If you desire, we would be available to assist you in the design of the walls incorporating these considerations. However, such analyses go beyond the current scope of our geotechnical evaluation.

4.5 Construction Considerations

Groundwater seepage into shallow foundation and utility excavations is generally not anticipated to be a significant factor during construction. However, some accumulation from precipitation events, surface run-off, or seepage from perched groundwater sources could be encountered. We anticipate standard sump pit and pumping procedures should generally be adequate to control these accumulations on a localized basis. A working surface of either crushed aggregate or crushed concrete may be required to protect the exposed subgrade where seepage is encountered.

The exposed subgrade soils may be easily disturbed due to weather and activity on-site. Therefore, the contractor should remove standing water from areas where water collects and prevent surface water from reaching the footing excavations and areas of prepared subgrade. Also, to reduce the potential of subgrade disturbance across the site, construction traffic should be restricted to special construction roads and not be allowed to randomly traffic the site. Disturbed soils may require moisture conditioning and recompaction in-place, or undercutting and replacement with engineered fill. Moisture conditioning may not be feasible during seasonally cold and wet times of the year, resulting in a potential need for additional imported fill if the work is performed between the late fall and early spring seasons. Areas of exposed subgrade at the site may be protected by placing crushed concrete or crushed aggregate on it. Under adverse weather conditions, the placement of a geotextile fabric for separation between the crushed aggregate and the exposed subgrade may be beneficial. Performing site work during the drier summer months should reduce the potential for subgrade disturbance and the need for improvement of the subgrade.

Contractors should include densification of foundation and grade slab subgrades in their base bids, and should provide unit prices for removal and disposal of unsuitable soils and replacement with engineered fill.

The contractor must take precautions to protect adjacent existing structures and utilities during construction of the new building addition. Care must be exercised during the excavating and compacting operations so that excessive vibrations do not cause settlement of the existing structures and utilities, and avoid undermining existing foundations or utilities during excavation for new foundations. Where sufficient space or setback from existing utilities or structures exists, we anticipate the sides of the excavation can be temporarily sloped back in accordance with applicable regulations. However, in areas where sufficient setback cannot be maintained, temporary earth retention systems will be required during construction.

Where new foundations adjoin existing foundations, the new foundations should not extend below the level of the existing footings without underpinning of the existing footings. Underpinning should be properly designed by a qualified professional engineer, and installed by a contractor experienced with construction of underpinning systems. SME can assist with underpinning design, however, it is outside of our current scope of services.

The contractor must provide a safely sloped excavation or an adequately constructed and braced shoring system in accordance with federal, state, and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

5.0 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

This section contains preliminary recommendations for design and construction of the proposed asphalt concrete pavements. Based on our review of the referenced drawings, new drives are planned west and south of the existing building. The new drives will intersect at a perpendicular angle and will replace the existing curved drive, which is currently located within the proposed parking lot footprint. A new parking lot and drop-off loop are planned between the proposed drives and building addition. In addition, a truck dock is proposed at the northeast corner of the existing building, which corresponds to the southwest corner of Dewey Lane. The eastern portion of the Dewey Lane will be expanded to the north to accommodate new delivery truck traffic.

The proposed pavement areas are surfaced with grass, existing pavements, and occasional trees. We understand the existing pavements in the area of proposed pavements will be completely removed prior to construction of the new pavements.

We were not provided with a final grading plan; however, based on the referenced documents, we anticipate cuts and fills of less than 1 foot will be required to reach the design subgrade levels for the proposed pavements. In the truck dock area, we anticipate cuts of approximately 1 to 4 feet will be required to achieve design grades. Pavement recommendations for the (assumed rigid pavement) loading dock were not included as part of the requested scope of services.

We recommend using the existing pavements as a construction platform prior to commencing pavement reconstruction. Leaving the existing pavement in place during building construction should lessen the risks associated with damaging an exposed subgrade. We do not recommend using the new leveling course as a construction platform. The leveling course is not designed to withstand heavy loads and use of the leveling course as a construction platform will likely result in premature pavement distress.

5.1 Traffic

General traffic information for the pavement areas was provided by Mr. Rossell, PE. We understand that the parking lots and portions of the new access drives will be exposed to automobiles and light duty passenger and delivery (postal/parcel) trucks only. Based on our conversation with Mr. Rossell, PE, we understand that less than two to three heavy delivery trucks will access the north drive and truck dock per week. Based on our experience with similar pavements and traffic loading, we estimate a total of 50,000 ESALs over a 20-year period for pavements that will only be exposed to automobile and light truck traffic. For the heavy-duty drives, we estimate a total of 100,000 ESALs over a 20 year period. If these traffic assumptions vary significantly from the actual traffic loading at the site, SME should be contacted in order to review and revise our recommendations.

5.2 Subgrade Conditions

Five borings (P1 through P5) were performed within the proposed pavement areas. Borings P1 through P3 were performed within the proposed parking lot and drive realignment area and borings P4 and P5 were performed in the north drive expansion. After removal of topsoil and topsoil fill (P4), we anticipate the exposed pavement subgrade will consist of suitable natural sands. N-values within the upper 5 feet ranged from 7 to 15 bpf indicating loose to medium dense conditions. Refer to Section 3.1 above and the attached boring logs for specific soil and groundwater conditions encountered at the site.

5.3 Subgrade Preparation

In general, subgrade preparations should follow the recommendations set forth in Section 4.1 of this report, except as modified below. Based on the borings, it is our opinion that exposed subgrade soils will provide marginal to good support for both construction operations as well as for support of the proposed pavement structure.

The proposed pavement areas should be cleared and grubbed by removing all surface vegetation, topsoil, existing pavement, unsuitable fill, and other deleterious materials to expose suitable subgrade soils. Tree root mats should be completely removed. The top 12 inches of the exposed subgrade and all engineered fill placed within the pavement area should be compacted to a minimum of 95 percent of the maximum Modified Proctor dry density. We recommend using a vibratory smooth-drum roller to uniformly compact the exposed subgrade. Subgrade preparation and new aggregate base placement should extend out to at least 12 inches beyond the edge of pavement or curbs to provide support for the outer edges of the pavement.

Prior to aggregate base placement, the subgrade should be proofrolled with a loaded tandem axle truck or other suitable rubber tire equipment. Any yielding areas should be stabilized by additional compaction, undercutting, and replacing with engineered fill, or by other means as dictated by the site conditions at the time of construction. Engineered fill placed in pavement areas should meet the requirements of Section 4.1.4 of this report.

Once the aggregate base is placed and compacted, the final subgrade should be proofrolled thoroughly prior to paving, with a fully loaded tandem axle dump truck. The criteria for the final proofroll should be a maximum of 1/4 inch of deflection or rutting. Once the subgrade passes the final proofroll, the pavement layers should be placed soon thereafter to avoid further subgrade disturbance. If the subgrade is subjected to disturbance including construction traffic or wet and/or freezing weather conditions, the subgrade should be re-evaluated prior to placement of the pavement layers. Likewise, if the aggregate base layer is subjected to disturbance or becomes wet due to inclement weather, it should be re-evaluated prior to placement of the asphalt concrete. These measures should mitigate premature pavement failure.

5.4 Recommended Pavement Sections

Provided in this section are our preliminary recommendations for pavement cross-sections. The recommended pavement sections selected are based on the information presented in the previous sections of this report and our experience with similar traffic volumes. The pavement cross sections are considered minimum sections for the expected loading described and supported by acceptably prepared and approved subgrade soils. The recommended layer materials refer to standard material designations listed in the latest edition of the "Standard Specifications for Construction" prepared by the Michigan Department of Transportation (MDOT), unless otherwise modified in this report. Any substitution of materials or deviation from these stated assumptions should be reviewed to assess potential impact on the recommended design.

Routine maintenance such as crack sealing, patching, and thin overlays should be performed such that water infiltration and frost heave effects associated with the local climate are minimized. The following presents the layer material and thickness recommendations for the pavement sections:

LIGHT-DUTY ASPHALT CONCRETE PAVEMENT
RECOMMENDED MATERIALS AND LAYERS

LAYER	MATERIAL	THICKNESS (inch)
Bituminous Surface	MDOT 13A Modified	1.5
Bituminous Leveling	MDOT 13A Modified	2.0
Aggregate Base	MDOT 22A	8.0

HEAVY-DUTY ASPHALT CONCRETE PAVEMENT
RECOMMENDED MATERIALS AND LAYERS

LAYER	MATERIAL	THICKNESS (inch)
Bituminous Surface	MDOT 13A Modified	1.5
Bituminous Leveling	MDOT 13A Modified	2.5*
Aggregate Base	MDOT 22A	10.0

***Leveling course should be increased to 3.0 in front of the proposed truck dock.**

Asphalt pavements are susceptible to rutting and shoving under slow moving heavy loads. These effects are magnified under tight turning conditions similar to the proposed truck dock area. We have recommended MDOT 13A Modified for the wearing course instead of a more estheticly favorable mix such as MDOT 36A. MDOT 13A Modified is a higher stability mixture and is more suitable for the tight turning radius near the truck dock. If desired, MDOT 36A may be used for the wearing course in light-duty areas. **We strongly recommend the use of a Portland cement concrete (PCC) section along the turning radius in front of the proposed truck dock.** We also recommend the use of a PCC section for dumpster pads.

The amount of recycled asphalt concrete (RAP) should be limited to 30 percent for leveling course layers. Wearing course mixtures should be limited to 15 percent RAP. The MDOT 13A should be modified to provide a minimum of 60% crushed content. The MDOT 13A and 36A (if substituted) should also be modified to provide 3% air voids and a minimum stability of 1,100 pounds.

5.5 Drainage

The pavement system must be properly drained to reduce the susceptibility of frost heaving and softening of the subgrade due to water infiltrating through cracks and/or joints. The infiltrated water, if not properly drained, is known to adversely affect the pavement performance. We recommend the drives be constructed using a crowned section rather than inverted crown drainage. A crowned section should provide better pavement performance by directing water flow away from the center of the pavement area. An underdrain system is not considered necessary based to the granular soils and absence of groundwater in the borings. However, it is essential that the ground surface adjacent to the pavement areas be sloped away from the pavement. If this is not possible due to existing site grades, cutoff drains should be installed along the pavement where the adjacent ground surface slopes downward toward the pavement. This will inhibit water from entering the base materials and weakened the subgrade.

We also recommend that a heavy-duty trench drain be installed at the bottom of the truck dock to drain surface water in the dock. The trench drain should outlet to the existing storm sewer system.

5.6 Construction Notes

To provide adequate service life and protect the pavement investment, we present the following construction notes. These notes should be included in the project specifications and should be implemented during the construction activities:

1. In general, earthwork and pavement construction should be performed in accordance with the most current edition of the MDOT Standard Specifications for Construction unless otherwise noted in the following items.
2. Remove any existing topsoil, pavements, organic soils, vegetation, trees, unsuitable fill, and deleterious materials to expose the subgrade soil. Tree roots should be completely removed.
3. Excavate to the depth of the final subgrade elevation to allow for grade changes and the placement of the recommended pavement system.

4. On site fill material can be used if the specified compaction requirements can be achieved. If on site material is used, it should be clean and free of frozen soil, organics, or other deleterious materials.
5. The top 12 inches of the exposed subgrade as well as individual fill layers should be compacted to achieve a minimum of 95 percent of the maximum Modified Proctor dry density.
6. The final subgrade should be thoroughly proofrolled using a fully loaded tandem axle truck under the observation of a geotechnical/pavement engineer. Loose or yielding areas that cannot be mechanically stabilized should be removed and replaced with engineered fill or as dictated by field conditions.
7. The aggregate base and subbase should be compacted to achieve a minimum of 95 percent of the maximum Modified Proctor dry density. The base, subbase, and subgrade compaction should extend a minimum of 12 inches beyond the paved edge.
8. All bituminous material should be compacted to a density of 94 to 97 percent of the theoretical maximum density as determined by the Rice Method.
9. A bond coat of SS-1h emulsion should be required between the leveling course and the wearing course. The bond coat should be applied in a uniform manner over the surface at a rate of 0.1 gallons/s.y.
10. Performance grade PG64-22 asphalt cement shall be used in the production of all bituminous mixtures.
11. Final pavement elevations should be designed to provide positive surface drainage. A minimum surface slope of 1.5% is recommended.
12. Cutoff drains should be installed along edges of the pavement where the adjacent ground surface is higher.
13. These recommendations assume typical conditions during the June through September construction season. Any substitution of materials or deviation from these stated assumptions should be reviewed to assess potential impact on the recommended design.

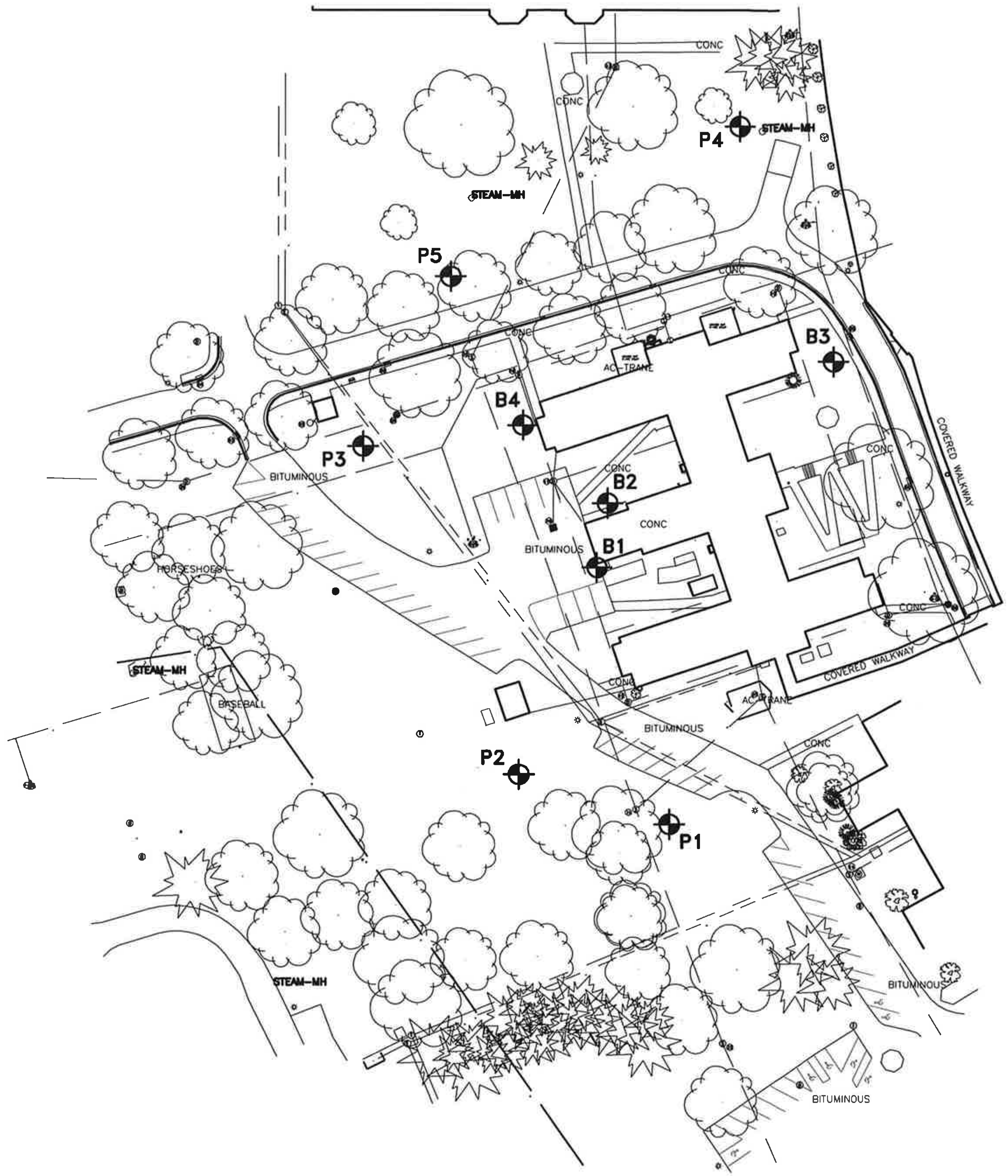
APPENDIX A:

BORING LOCATION DIAGRAM

GEOTECHNICAL NOTES

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

BORING LOGS (B1 THROUGH B4 AND PI THROUGH P5)



NORTH

0' 80' 160'

GRAPHIC SCALE: 1" = 80'

LEGEND

⊕ APPROXIMATE BORING LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM : A DRAWING TITLED "RENOVATE MENTAL HEALTH CLINIC B-7", DATED 10-07-11 AND PROVIDED BY ALBERT KAHN ASSOCIATES, INC.

Oct 17, 2011 - 11:51am - MANDRILA
S:\64000\064433.00\DWGS\rev0\064433.00-01.dwg

No.	Revision Date

BORING LOCATION DIAGRAM
DEPT OF V.A.
RENOVATION OF HEALTH CLINIC B-7
BATTLE CREEK, MICHIGAN

Date	10-17-11
Drawn By	GM
Designed By	ATB
Scale	1" = 80'
Project	064433.00

Indiana
Michigan
Ohio

sme

www.sme-usa.com

Figure No. 1

soil and materials engineers, inc.

GEOTECHNICAL NOTES

Sampling Symbols

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
CS	–	Continuous Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
RC	–	Rock Core diamond bit. NQ size, except where noted
SS	–	Split-Spoon 1-3/8" I.D., 2" O.D. except where noted
VS	–	Vane Shear
WS	–	Wash Sample

Typical Abbreviations

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

Standard Penetration 'N-value' – Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

Particle Sizes

Boulders	-	Greater than 12 inches (305 mm)
Cobbles	-	3 inches (76.2 mm) to 12 inches (305 mm)
Gravel-Coarse	-	3/4 inches (19.05 mm) to 3 inches (76.2mm)
Fine	-	No. 4 (4.75 mm) to 3/4 inches (19.05 mm)
Sand- Coarse	-	No. 10 (2.00 mm) to No. 4 (4.75 mm)
Medium	-	No. 40 (0.425 mm) to No. 10 (2.00 mm)
Fine	-	No. 200 (0.074 mm) to No. 40 (0.425 mm)
Silt	-	0.005 mm to 0.074 mm
Clay	-	Less than (0.005 mm)

Depositional Features

Parting	-	as much as 1/16 inch (1.6 mm) thick
Seam	-	1/16 inch (1.6 mm) to 1/2 inch (12.7 mm) thick
Layer	-	1/2 inch (12.7 mm) to 12 (305 mm) inches thick
Stratum	-	greater than 12 inches (305 mm) thick
Pocket	-	small, erratic deposit of limited lateral extent
Lens	-	lenticular deposit
Varved	-	alternating seams or layers of silt and/or clay and sometimes fine sand
Occasional	-	one or less per foot (305 mm) of thickness
Frequent	-	more than one per foot (305 mm) of thickness
Interbedded	-	applied to strata of soil or beds of rock lying between or alternating with other strata of a different nature

Groundwater levels indicated on the boring log are the levels measured in the boring at the times indicated. The accurate determination of groundwater levels may not be possible with short term observations, especially in low permeability soils. The groundwater levels shown may fluctuate throughout the year with variation in precipitation, evaporation and runoff.

Classification

Cohesionless Soils (Blows per foot or 0.3 m)

Very Loose	:	0 to 4
Loose	:	5 to 9
Medium Dense	:	10 to 29
Dense	:	30 to 49
Very Dense	:	50 to 80
Extremely Dense	:	Over 80

Soil Constituents

Trace	:	Less than 5%
Trace to Some	:	5% to 12%
Some	:	12% to 25%
Use Descriptor (i.e., Silty, Clayey, etc.)	:	25% to 50%

Cohesive Soils

Consistency		Shear Strength
Very Soft	:	0.25 kips/ft^2 (12.0 kPa) or less
Soft	:	0.25 to 0.49 kips/ft^2 (12.0 to 23.8 kPa)
Medium	:	0.50 to 0.99 kips/ft^2 (23.9 to 47.7 kPa)
Stiff	:	1.00 to 1.99 kips/ft^2 (47.8 to 95.6 kPa)
Very Stiff	:	2.00 to 3.99 kips/ft^2 (95.7 to 191.3 kPa)
Hard	:	4.00 kips/ft^2 (191.4 kPa) or greater

Soil description

If clay content sufficiently dominates soil properties, then clay becomes the primary noun with the other major soil constituent as modifier: i.e. silty clay. Other minor soil constituents may be added according to estimates of soil constituents present, i.e., silty clay, trace to some sand, trace gravel.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
		Clean Gravels (Less than 5% fines)
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels; sandy gravels, little or no fines
	GP	Poorly-graded gravels; sandy gravels, little or no fines
		Gravels with fines (More than 12% fines)
	GM	Silty gravels, some sand or sandy gravels, some silt
	GC	Clayey gravels, some sand or sandy gravels, some silt
		Clean Sands (Less than 5% fines)
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
		Sands with fines (More than 12% fines)
	SM	Silty sands or sands, some silt
	SC	Clayey sands or sands, some clay
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts, sandy silts or clayey silts with slight plasticity
	CL	Inorganic clays of low plasticity, sandy clays, silty clays
	OL	Organic silts and organic clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts of high plasticity
	CH	Inorganic clays of high plasticity
	OH	Organic silts and organic clays of high plasticity
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

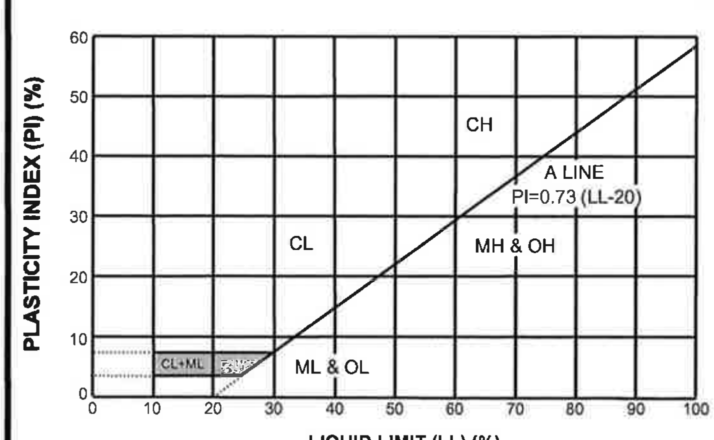
LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI be-tween 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent..GW, GP, SW, SP
More than 12 percent..GM, GC, SM, SC
5 to 12 percent........................Borderline cases requiring dual symbols

PLASTICITY CHART



soil and materials engineers, inc.
michigan, ohio and indiana

BORING B 1

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11 **BORING METHOD:** Hollow-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 916.6 FT

Depth (feet)	Profile Description	Elevation (feet)
0.3	Driller Reported 3.5 inches of Asphalt Concrete	916.3
3.0	Fine to Medium Sand- Some Silt- Trace Gravel- Frequent Topsoil Layers and Seams- Brown- Moist- Medium Dense (SM/Fill)	913.6
8.0	Fine to Medium Sand- Some Silt- Trace Gravel- Occasional Clayey Sand Seams- Brown- Moist- Loose (SM)	908.6
12.0	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Medium Dense (SP-SM)	904.6
22.0	Fine to Medium Sand- Trace Gravel and Silt- Brown- Moist- Medium Dense (SP)	894.6
26.0	Fine to Coarse Sand- Some Gravel- Trace Silt- Brown- Moist- Medium Dense (SP)	890.6
	Fine Sand- Trace Silt- Brown- Moist- Medium Dense to Very Dense (SP)	

Sample Type/No.	Blows per Six Inches	N-Value
SS1	9, 10, 10	20
SS2	3, 4, 5	9
SS3	4, 4, 4	8
SS4	5, 6, 6	12
SS5	7, 8, 10	18
SS6	8, 9, 8	17
SS7	11, 12, 14	26
SS8	8, 8, 9	17

DRY DENSITY (pcf) – 90 100 110 120
MOISTURE & ATTERBERG LIMITS (%) – PL MC LL – 10 20 30 40
HAND PENETROMETER; TORVANE SHEAR; UNCONFINED COMPRESSION; VANE SHEAR (PEAK); VANE SHEAR (REMOLDED); TRIAXIAL (UU)
SHEAR STRENGTH (KSF) 1 2 3 4

REMARKS: Based on a loss-on-ignition (LOI) test performed on a topsoil layer in sample SS1, the organic matter of the topsoil is 4.9%.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Lower level at about 34 feet south and 74 feet east of existing NW building corner established as project datum equal to approximate elevation of 914.8 feet.

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(Continued Next Page)

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BORING B 1

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7 **PROJECT NUMBER:** 064433.00

CLIENT: Albert Kahn Associates, Inc. **PROJECT LOCATION:** Battle Creek, Michigan

SURFACE ELEVATION: 916.6 FT

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE	REMARKS
30.0–37.0	Fine Sand- Trace Silt- Brown- Moist- Medium Dense to Very Dense (SP) *(continued)*	879.6	SS9	19 21 30	>>51	
37.0–40.0	Fine Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Very Dense (SP-SM)	876.6	SS10	25 27 28	>>55	
40.0–47.0	Fine to Coarse Sand- Some Gravel- Trace Silt- Brown- Moist- Extremely Dense (SP)	869.6	SS11	41 50/4"	>>50/4"	
47.0–60.0	Fine Sand- Trace to Some Silt- Brown- Moist- Medium Dense to Dense (SP-SM)	856.6	SS12	8 10 11	21	
			SS13	11 13 16	29	
			SS14	14 14 16	30	

END OF BORING AT 60.0 FEET.

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BORING B 2

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7 **PROJECT NUMBER:** 064433.00
CLIENT: Albert Kahn Associates, Inc. **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 10/7/11 **COMPLETED:** 10/7/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 916.6 FT

Depth (feet)	Elevation (feet)	Profile Description	Sample Type/No.	Blows per Six Inches	N-Value	Remarks
0.8	915.8	Driller Reported 10 inches of Sandy Topsoil- Dark Brown				
3.0	913.6	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Occasional Brick Fragments- Brown- Moist- Loose (SP-SM/Fill)	SS1	3 4 3	7	
12.0	904.6	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Loose (SP-SM)	SS2	2 3 3	6	
			SS3	3 3 2	5	
			SS4	3 4 4	8	
		Fine to Medium Sand- Trace Gravel and Silt- Brown- Moist- Medium Dense to Dense (SP)	SS5	5 6 8	14	
			SS6	10 10 12	22	
			SS7	13 14 14	28	
			SS8	15 16 15	31	

Legend: DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40); N-VALUE – O (10 20 30 40); ▽ HAND PENETROMETER; ⊠ TORVANE SHEAR; O UNCONFINED COMPRESSION; ⊡ VANE SHEAR (PEAK); X VANE SHEAR (REMOLDED); ◆ TRIAXIAL (UU); SHEAR STRENGTH (KSF) (1 2 3 4)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Lower level at about 34 feet south and 74 feet east of existing NW building corner established as project datum equal to approximate elevation of 914.8 feet.

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BORING B 2

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

SURFACE ELEVATION: 916.6 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE – O	DRY DENSITY (pcf) / MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
886.6 – 876.6	30 – 40.0	Fine to Medium Sand- Trace Gravel and Silt- Brown- Moist- Medium Dense to Dense (SP) *(continued)*	SS9	9 10 12	22			
			SS10	6 7 7	14			
876.6	40.0	END OF BORING AT 40.0 FEET.						

Legend: ▽ HAND PENETROMETER; ⊠ TORVANE SHEAR; O UNCONFINED COMPRESSION; ▣ VANE SHEAR (PEAK); X VANE SHEAR (REMOLDED); ◆ TRIAXIAL (UU)

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BORING B 3

PAGE 1 OF 1

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7 **PROJECT NUMBER:** 064433.00

CLIENT: Albert Kahn Associates, Inc. **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 10/7/11 **COMPLETED:** 10/7/11 **BORING METHOD:** Solid-stem Augers

DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 919.5 FT

Depth (feet)	Profile Description	Elevation (feet)	Sample Type/No.	Blows per Six Inches	N-Value
0.7	Driller Reported 8 inches of Sandy Topsoil- Dark Brown	918.8			
4.0	Fine to Medium Sand- Some Silt- Trace Gravel- Occasional Topsoil Seams- Brown and Dark Brown- Moist- Medium Dense (SM/Fill)	915.5	SS1	6 7 6	13
			SS2	2 3 3	6
12.0	Fine to Medium Sand- Some Silt- Trace Gravel- Brown- Moist- Loose (SM)	907.5	SS3	3 3 3	6
			SS4	3 4 3	7
17.0	Fine Sand- Trace Gravel and Silt- Brown- Moist- Medium Dense (SP)	902.5	SS5	5 6 8	14
30.0	Fine to Coarse Sand- Trace to Some Gravel- Trace Silt- Brown- Moist- Medium Dense (SP)	889.5	SS6	7 10 12	22
			SS7	6 6 7	13
			SS8	9 10 9	19

END OF BORING AT 30.0 FEET.

Chart columns (no data plotted except N-values): DRY DENSITY (pcf) – ■ 90 100 110 120; MOISTURE & ATTERBERG LIMITS (%) PL MC LL 10 20 30 40; ▽ HAND PENETROMETER, ⊠ TORVANE SHEAR, ○ UNCONFINED COMPRESSION, ⊡ VANE SHEAR (PEAK), X VANE SHEAR (REMOLDED), ◆ TRIAXIAL (UU), SHEAR STRENGTH (KSF) 1 2 3 4; REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Lower level at about 34 feet south and 74 feet east of existing NW building corner established as project datum equal to approximate elevation of 914.8 feet.

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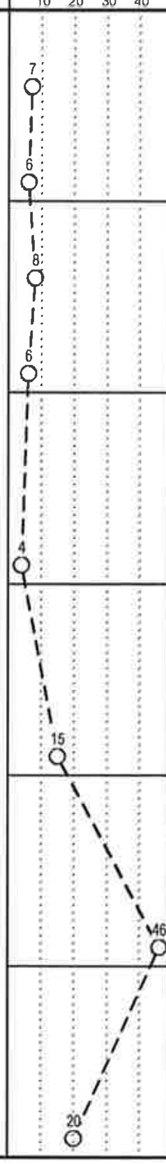
BORING B 4

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 10/7/11 **COMPLETED:** 10/7/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 917.9 FT

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	N-VALUE
0.8	Driller Reported 10 inches of Sandy Topsoil- Dark Brown	917.1			
6.0	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Occasional Topsoil Seams- Brown- Moist- Loose (SP-SM/Fill)	911.9	SS1	3 4 3	7
			SS2	2 2 4	6
13.5	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Loose (SP-SM)	904.4	SS3	3 3 5	8
			SS4	3 3 3	6
17.0	Fine to Medium Sand- Trace Silt and Gravel- Brown- Moist- Very Loose (SP)	900.9	SS5	1 2 2	4
22.0	Fine Sand- Trace Silt- Brown- Moist- Medium Dense (SP)	895.9	SS6	6 7 8	15
26.0	Fine to Medium Sand- Trace to Some Gravel and Silt- Brown- Moist- Dense (SP-SM)	891.9	SS7	19 20 26	46
30.0	Fine to Medium Sand- Trace Gravel and Silt- Brown- Moist- Medium Dense (SP)	887.9	SS8	9 10 10	20



DRY DENSITY (pcf) – ■ 90 100 110 120
MOISTURE & ATTERBERG LIMITS (%) PL MC LL 10 20 30 40
▽ HAND PENETROMETER
⊠ TORVANE SHEAR
O UNCONFINED COMPRESSION
⊡ VANE SHEAR (PEAK)
X VANE SHEAR (REMOLDED)
◆ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) 1 2 3 4
REMARKS

END OF BORING AT 30.0 FEET.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Lower level at about 34 feet south and 74 feet east of existing NW building corner established as project datum equal to approximate elevation of 914.8 feet.

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BORING P 1

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 918.5± FT

DEPTH (FEET)	ELEVATION (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE	DRY DENSITY (pcf)	MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
0–1.3	917.2	16 inches of Silty Fine Sand- Occasional Root Fibers- Dark Brown- Moist (SM/Topsoil)							
1.3–4.5	914.0	Fine to Medium Sand- Some Silt- Trace Gravel- Brown- Moist- Medium Dense to Loose (SM)	SS1	5 6 6	12				
			SS2	3 4 5	9				
4.5–5.0	913.5	Fine Sand- Trace Gravel and Silt- Brown- Moist- Loose (SP)							

END OF BORING AT 5.0 FEET.

Legend: HAND PENETROMETER; TORVANE SHEAR; UNCONFINED COMPRESSION; VANE SHEAR (PEAK); VANE SHEAR (REMOLDED); TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

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BORING P 2

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 917± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE – O	DRY DENSITY (pcf) / MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
916.2	0.8	Driller Reported 9 inches of Sandy Topsoil- Dark Brown						
914.0	3.0	Fine to Medium Sand- Some Silt- Trace Gravel- Brown- Moist- Medium Dense (SM)	SS1	4 5 5	10			
912.0	5.0	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Loose (SP-SM)	SS2	2 4 3	7			

END OF BORING AT 5.0 FEET.

Legend: ▽ HAND PENETROMETER; ⊠ TORVANE SHEAR; O UNCONFINED COMPRESSION; ⊡ VANE SHEAR (PEAK); X VANE SHEAR (REMOLDED); ◆ TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

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BORING P 3

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 917.5± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE	DRY DENSITY (pcf)	MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
916.8	0.7	Driller Reported 8 inches of Sandy Topsoil- Dark Brown							
914.5	3.0	Fine to Medium Sand- Some Silt- Trace Gravel and Clay- Brown- Moist- Medium Dense (SM)	SS1	6 6 8	14				
912.5	5.0	Fine Sand- Trace Gravel and Silt- Brown- Moist- Loose (SP)	SS2	3 4 5	9				
		END OF BORING AT 5.0 FEET.							

Legend: ▽ HAND PENETROMETER; ⊠ TORVANE SHEAR; O UNCONFINED COMPRESSION; ⊡ VANE SHEAR (PEAK); X VANE SHEAR (REMOLDED); ◆ TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

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BORING P 4

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7 **PROJECT NUMBER:** 064433.00
CLIENT: Albert Kahn Associates, Inc. **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11 **BORING METHOD:** Solid-stem Augers
DRILLER: JR **RIG NO.:** 253 **LOGGED BY:** KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 920.5± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
920 – 918.5	0 – 2.0	Silty Fine to Medium Sand- Trace to Some Gravel- Occasional Root Fibers and Brick Fragments- Dark Brown- Moist- Loose (SM/Topsoil/Fill)	SS1	3 3 4	7			
918.5 – 917.5	2.0 – 3.0	Fine to Coarse Sand- Some Silt- Trace Gravel- Brown- Moist- Loose (SM)						
917.5 – 915.5	3.0 – 5.0	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Loose (SP-SM)	SS2	3 4 3	7			

END OF BORING AT 5.0 FEET.

Elevation scale: 920, 915, 910, 905, 900, 895. Depth scale: 0, 5, 10, 15, 20, 25, 30.

Shear strength legend: ▽ HAND PENETROMETER; ⊠ TORVANE SHEAR; O UNCONFINED COMPRESSION; ⊡ VANE SHEAR (PEAK); X VANE SHEAR (REMOLDED); ◆ TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

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BORING P 5

PROJECT NAME: Dept. of V.A.-Renovation of Health Clinic B-7
PROJECT NUMBER: 064433.00
CLIENT: Albert Kahn Associates, Inc.
PROJECT LOCATION: Battle Creek, Michigan
DATE STARTED: 10/10/11 **COMPLETED:** 10/10/11
BORING METHOD: Solid-stem Augers
DRILLER: JR **RIG NO.:** 253
LOGGED BY: KJG **CHECKED BY:** ATB

SURFACE ELEVATION: 918± FT

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	N-VALUE	REMARKS
0.5	Driller Reported 6 inches of Sandy Topsoil- Dark Brown	917.5				
3.5	Fine to Medium Sand- Trace to Some Silt- Trace Gravel- Brown- Moist- Medium Dense (SP-SM)	914.5	SS1	6 8 7	15	
5.0	Fine Sand- Trace to Some Silt- Brown- Moist- Medium Dense (SP-SM)	913.0	SS2	5 6 6	12	

END OF BORING AT 5.0 FEET.

Chart axes: ELEVATION (FEET) 915, 910, 905, 900, 895, 890; DEPTH (FEET) 0, 5, 10, 15, 20, 25, 30; N-VALUE – O 10 20 30 40; DRY DENSITY (pcf) – ■ 90 100 110 120; MOISTURE & ATTERBERG LIMITS (%) PL MC LL 10 20 30 40; SHEAR STRENGTH (KSF) 1 2 3 4 — ▽ HAND PENETROMETER, ⊠ TORVANE SHEAR, O UNCONFINED COMPRESSION, ⊡ VANE SHEAR (PEAK), X VANE SHEAR (REMOLDED), ◆ TRIAXIAL (UU)

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

October 26, 2011

APPENDIX B:

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

GENERAL COMMENTS

LABORATORY TESTING PROCEDURES

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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GENERAL COMMENTS

Basis of Geotechnical Report

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

Review of Design Details, Plans, and Specifications

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

Review of Report Information With Project Team

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

Field Verification of Geotechnical Conditions

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

Project Information for Contractor

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

Third Party Reliance/Reuse of This Report

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

LABORATORY TESTING PROCEDURES

Visual Engineering Classification

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

Moisture Content

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110° C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

Hand Penetrometer Tests

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

Torvane Shear Tests

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

Loss-on-Ignition (Organic Content) Tests

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440° C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

Atterberg Limits Tests

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.